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Impact analysis of atmospheric instability indices in forecasting process using data mining methods

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Operational forecasters use atmospheric instability indices, as tools or parameters, to address the overall threat of severe weather associated with convective storms. Indeed, the value of such variables is strongly associated with their capacity to summarize in a single number some thermodynamic characteristics resulting in favorable atmospheric conditions for convective weather. The data mining (DM) computational process is an interdisciplinary subfield of computer science, that uses algorithms and data analysis tools, involves methods at the intersection of artificial intelligence, machine learning, statistics and database systems. The implementation of DM is to discover patterns and relationships in data sets that may be used to make valid predictions and evaluate the impact of different parameters. In this paper, DM is applied on a database of convective weather, using the Waikato Environment for Knowledge Analysis (WEKA) suite, that developed at the University of Waikato, New Zealand. The convective weather database consists of lightning activity reports (2008 -2014) by the Hellenic National Meteorological Service (HNMS) and several atmospheric variables of lower and middle troposphere from the ERA-Interim reanalysis dataset of the European Centre for Medium-Range Weather Forecasts. Upper air remote sensing data from HNMS's upper air network fulfils our database. The findings of the analysis are presented on seasonal and monthly basis, illustrating the real impact of all examined atmospheric variables and instability indices to forecast convective weather conditions for specific sub geographical regions in Greece.

Keywords: atmospheric instability indices, convective weather, thunderstorm, lightning, ECMWF, ERA-Interim, Greece, HNMS, data mining, artificial intelligence, machine learning, WEKA